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## (54) IMPROVEMENTS IN AND RELATING TO BAGGAGE HANDLING SYSTEM

(71) We, RAPISTAN INCORPORATED, a Corporation of the State of Michigan, United Staes of America, of 507 Plymouth Road, N.E., Grand Rapids, Michigan, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to baggage handling systems and to containers for use in such systems.

The conventional baggage handling systems such as utilized at airports are reaching the point of total inadequacy. The lack of automation and the need for manual assistance with and control over the bags which are deplaning have resulted in long delays for passengers desiring the claim their bags. In addition, inasmuch as all of the bags are discharged at an apron or pick-up point regardless of the presence of the owner, theft of unattended bags is a serious risk. If there are any attendants present at the pick-up points they are usually too busy to insist that claimers produce their baggage check so as to verify ownership. Theft becomes a particularly acute problem in those cases in which for some reason or other the baggage does not come in on the same plane as the passenger, requiring the passenger to return at some later time to pick up the bag. In the interim, the bag remains on the apron in the obvious absence of its proper claimant, thus inviting theft.

At the initiating or enplaning end of the process, the lack of automated means for dispensing the bags to the proper plane is a source of error inasmuch as many conventional systems require an individual to read correctly the baggage checks on the bags to ascertain to which flight the bags are to be dispatched. While a substantial advance in resolving this problem was effected by the system disclosed in U.S. Patent 3,206,349, this invention substantially improves upon that advance.

Another problem concerns the containers heretofore developed for delivering articles to various stations. In the art of small sorting, containers have been constructed with door operating mechanisms which push against the containers contents prior to their unlatching. Such containers are not reliable for the delivery of heavy articles such as baggage because the weight of the baggage may jam the door-operating mechanism.

According to one aspect of the present invention, a baggage conveyor system comprises: a plurality of baggage carriers; a discharge station; means at the discharge station for receiving a coded signal and supplying it to comparing means; means arranged to supply to the comparing means signals denoting the baggage carried by at least one of the carriers; and at least one actuator element which is arranged to cause a carrier to discharge its load at the discharge station in response to a finding by the comparing means of compatibility between the signals denoting the baggage carried by that carrier and the signals received by the receiving means.

It will be realised that this system can be used for the arrivals section of an airport to deliver baggage from a plane to the owner who is ready to receive it. The system may also be used for the departure section of an airport to deliver baggage from a check-in point to an assembly point for transfer to the aircraft. Preferably the arrivals and departure sections are integrated into a single baggage handling system which employs the same carriers for the two sections.

The system may include means for storing the carriers with their contents and locating means arranged to search at least the storing means in order to locate the carrier identified by a signal received by the receiving means at the discharge station.

The invention may be carried into practice in various ways but a baggage handling

system and a number of different forms of baggage carriers which can be used in the system will now be described by way of example with reference to the accompanying drawings, in which:—

Figure 1 is a schematic diagram of one possible floor plan layout of the baggage system as it might be utilized in a representative airport;

Figure 2 is a perspective view of an unloading or loading station constituting a part of the system;

Figure 3 is a perspective view of the baggage bin slides as would be used for loading a plane;

Figure 4 is a perspective view of the baggage slide at a baggage claim area;

Figure 5 is a perspective view of one of the carriers for baggage;

Figure 6 is a side elevational view of a discharge station;

Figure 7 is a schematic illustration of one embodiment of the opening mechanism for the carrier illustrated in Figure 5;

Figure 8 is an end elevational view taken along the lines VIII—VIII of Figure 7;

Figure 9 is a sectional view taken along the lines IX—IX of Figure 7;

Figure 10 is a fragmentary enlargement of the schematic view illustrated in Figure 8, with the parts occupying the opened position;

Figure 11 is a perspective view of an alternative embodiment of the carrier illustrated in Figure 5;

Figure 12 is a side elevational view of the carrier illustrated in Figure 11 with the exterior of the side wall removed;

Figure 13 is a fragmentary sectional elevational view taken along the plane XIII—XIII of Figure 12;

Figure 14 is a schematic diagram illustrating the hook-up of the computer system;

Figure 14A is a schematic diagram of a control system applied to a conveyor system designed only to handle baggage from a check-in station to an outbound flight loading station;

Figure 14B is a schematic diagram of a control system applied to a conveyor system designed only to handle baggage from an inbound flight unloading station to a baggage claim station;

Figure 15 is a top perspective view of yet another embodiment of the baggage carrier and illustrating the door closing mechanism;

Figure 16 is a bottom perspective view of the carrier of Figure 15;

Figure 17 is a sectional elevation view taken along the plane XVII—XVII of Figure 16 showing the door in normally closed position;

Figure 18 is a view identical to Figure 17 but showing the door raised to release position;

Figure 19 is a fragmentary, perspective view of the conveyor at a discharge station;

Figure 20 is a fragmentary, sectional elevation view taken along the plane XX—XX of Figure 19;

Figure 21 is a perspective view of a carrier having a modified door mounting;

Figure 22 is a fragmentary vertical sectional view of the door end of the carrier shown in Figure 21 showing the door in closed and latched position;

Figure 23 is a view identical to Figure 22 but showing the door just after it has been released to open;

Figure 24 is a fragmentary bottom view of the hinge structure taken along the plane XXIV—XXIV of Figure 22;

Figure 25 is a schematic view of one form of indexing device for discharging baggage from the carriers;

Figure 26 illustrates a baggage claim check designed for use with one form of this invention;

Figure 27 illustrates a modification of the baggage claim check shown in Figure 26;

Figure 28 is a fragmentaary enlarged front view of a modified construction of the door hinge arrangement illustrated in Figures 16, 22 and 23;

Figure 29 is a view similar to Figure 28 showing the hinge actuator in door opening position;

Figure 30 is a fragmentary sectional view taken along the plane XXX—XXX of Figure 28; and

Figure 31 is a schematic diagram of a modified floor plan layout of a baggage system.

The drawings show a bagage handling system such as is utilized in an airport wherein baggage is checked in, delivered to a loading area where the bags are loaded on carts or baggage containers and transported to the plane, the airport having a loading area for bringing in deplaning bags for distribution to baggage claim areas. One such system is illustrated in Figure 1 as representative. Other layouts may be utilized, such as a layout wherein the dispensing station for loading the baggage onto the airplanes is not located adjacent to the deplaning loading area at which baggage is received from planes to be distributed to baggage claim areas.

The system, in the form illustrated, has a powered conveyor system 10. The conveyor transports specialized carriers in the form of containers 60, the containers being carried by conventional conveyor belts or other conventional conveyor means from one location to another. At the check-in area 20 (Figure 1), baggage is loaded into empty containers or trays waiting in line, each bag bearing conventional identification information such as destination and flight numbers. It may also include additional identification

such as the passenger's ticket number. To code the identification into the system at station 20, a coding and dispatching unit 22 is provided. If the departure time for the flight is within a predetermined time, such as within one hour from the entry of the container for that baggage into the system, the container is switched to a through track 29 which passes through the storage area. The container is then carried to a baggage sorting and dispensing station 30 wherein the baggage is discharged into bin slides 33 in a manner hereinafter described. If the departure time is more than the predetermined period after it has entered the system, the container is hunted to storage conveyor 32 at the end 34 thereof, so that each new storage adds to the contents of the storage area one at a time. As the departure time approaches, the tray or container is automatically located in the storage area on the conveyors 32 and retrieved therefrom onto the through conveyor 29 so as to be carried to the sorting and dispensing station 30. The remaining stored containers are indexed down one position at a time from their previous positions. Once sorted, the baggage is placed on conventional carts 36 and carried to the plane.

At the other end of the process baggage is brought to a loading station 39 from the plane on a cart 38 and the identifying information on the baggage check is coded into the system by means of the coding unit 22*a*, this unit being otherwise identical with unit 22 at the check-in station 20. The baggage is loaded onto a tray or container and the identity of the claimant is fed into the computer which associates this information with the identity of the tray. The identity of the claimant may be his ticket number or any other suitable means of identification. The tray or container with the deplaning baggage is then carried by a conveyor 40 to a switch location 42. A conventional high speed transport conveyor moving, for example, at approximately 20 miles per hour can be utilized for the conveyor 40.

When the loaded tray reaches the switching location 42, if no demand has been made for that particular baggage, the tray or container is shunted to the conveyor track 44 which carries the container into the storage area 28 as described for the enplaning baggage. To receive the baggage check of the passenger at the baggage claim area 46, baggage call units or receptors 48 are provided, which baggage call units each direct a coded signal into the system which signal is compared with the identifying information already supplied to the computer. If there is compatibility between that identity and the signal, the container is sent directly to the baggage claim area, or if in storage is called out of storage 28 and delivered to the baggage claim area, or if in storage is called out of storage 28 and delivered to the baggage claim area 46 by means of the high-speed conveyor track 49. At the area 46, the container discharges its contents to the customer. If the call is made by the units 48 prior to the container reaching the switching area 42 via conveyor 40, the container can be switched to conveyor track 50 so as to be brought into the baggage claim area immediately. Trays or containers emptied in the baggage claim area are either returned to the loading area for deplaned baggage or hunted into the enplaning area 20 for use by the check-in station.

## The Container

Having described the system, the container employed in the system will now be described. As illustrated in Figures 5 to 10, it comprises a four-sided tray 60 which is upwardly open. It has a bottom or floor 62, two generally vertically extending side walls 64 and an end or back wall 66. The sides and back can be made of any suitable material such as a formed plastics or glass-reinforced plastics. It also has a door 68 which, along with the floor 62, can be metal, the door 68 being hinged at 70 and held closed by a latch mechanism 72 at both sides of the door 68 (Figures 7, 8 and 10). The latch mechanism 72 comprises a latch 74 pivotally hinged at 76 to the walls 64 and slidably engaging a rod 78. To bias the latch 74 so as to move with the rod 78, yet permit the door 68 to close, a compression spring 80 is provided between the ends 79 of the rod 78 and the latch. This provides a limited lost motion connection. The rod 78 is movable within the side walls 64 and is reciprocated by a cam 82 at the end of each rod, the cam being being actuated by a wedge 84 positioned on the end of the actuating rods 86 located on or in back wall 66. The rods 86 are attached on a pivot plate 90 having a finger 92 projecting therefrom. A tension spring 94 having one end secured to the back wall 66 biases the pivot plate 90 into the vertical position. An actuating solenoid 96 in the path of travel of the container at a discharge station engages the finger 92, rotating the pivot plate 90. This forces the cams 82 to shift rearwardly releasing the door 68. The solenoid has a normally retracted trigger 98. When actuated, the trigger shifts to extended position where it engages the finger 92. The latches 74 have camming surfaces 99 formed on the front faces to facilitate closing of the door 68. The springs 80 provided sufficient lost motion for the latches to allow them to pivot out of the way when the door is being shut. The door closing mechanism is hereinafter described.

Figures 11, 12 and 13 illustrate an alternative embodiment of the latching mechanism

for the container or tray carrying the baggage. The parts in these embodiments which correspond to those previously described have the same reference numerals to which the distingushing suffix "*a*" has been added. In this construction, the door 68*a* is mounted to one of the side walls 64*a* by a hinge 50 and latched to the other side wall 64*a* by a latching mechanism 72*a*. The latching mechanism comprises a latch finger 74*a* mounted on one end of a rod 100 rotatably supported inside the wall 64*a*. The other end of the rod 100 mounts a camming finger 92*a* which serves the same purpose as the finger 92. The finger 92*a* is so positioned that it will be pivoted by the extended trigger 98 of the solenoid 96 in the manner described for the embodiment illustrated in Figures 7 and 8. The trigger pivots the finger to rotate the latch 74*a* downwardly, releasing the door 68*a* to swing outwardly on its hinge.

The latch is biased into closed position by a spring 101 mounted within the back wall of the container (Figure 13). One end is fixed to the container and the other to the lever 102 secured to the rod 100. To permit the door to be closed after the latch has returned to its normally closed position, the latch finger 74*a* can be provided with the same spring and lost motion connection illustrated in Figure 7. It will be obvious that various other latch arrangements to effect the same result may be utilized instead of those described.

In the embodiment illustrated in Figures 15, 16 and 17, the door 68*b* of the tray 60*b* is hinged to the floor 62*b* as in the case of the first described embodiment, but a different latching mechanism is utilized. The door 68*b* is connected to the floor 62*b* by a double-acting hinge 114 comprising hinges 115 and 116 mounted on the floor and the door, respectively, the two hinges being joined to each other by a plate 120. A release bar 117 pivots about a portion of the hinge 115, the bar having a nose 118 which projects under the hinge 116. When the bar 117 is pivoted about the hinge 115, the nose 118 presses against the undersurface of the hinge 116, forcing the hinge upwardly, lifting the stops 121 on the door 68*b* off the latches 119 projecting from the front of the sides 64*b* of the tray. This action is illustrated in Figures 17 and 18.

Figures 19 and 20 illustrates an actuator arrangement suitable for opening the door. The discharge station is provided with a ledge 130 immediately adjacent the conveyor track 131. This ledge 130 is so located that it is directly beneath the door mounting hinges of the containers as they pass through the discharge station. At suitably spaced intervals, such as three feet, the ledge is equipped with slotted apertures 132 in each of which is mounted a trigger 133. The trigger can be designed in several different forms but in the embodiment illustrated it is a wheel 134 rotatably mounted on the end of an arm 135. The opposite end of the arm is pivoted to the bracket 136 secured to the undersurface of the ledge 130. The trigger is extended in raised, operative position (shown in phantom in Figure 20) by a solenoid 137. The solenoid is connected to and is under the control of the computer.

When the trigger 133 is raised, it engages the release bar 117, as shown in Figure 18, thereby pivoting the bar 117 to its raised, door releasing position.

Figures 21—24 illustrate a modification of the container door arrangement shown in Figures 15—18. The container 60*c* has the same construction as the container 60*b*. The door 68*c* is mounted by means of a double-hinge assembly 140. The hinge assembly has one hinge 141 secured to the door and another hinge 142 secured to the bottom of the container. These hinges are joined by an elongated plate 143. Mounted on the plate 143 is a depending cam bracket 144 each end of which is sloped to form a ramp 145.

The sides of the door are notched at 146 to receive the latches 147. When the trigger 133 is raised, it engages the cam bracket 144, lifting the door 68*c* sufficiently to disengage the latches 147. Since the container at this point is inclined, the door opens automatically by gravity. The door is provided with a bumper or wear-strip 148 to support it on the baggage slide 149 when open. As an alternative, this strip can be mounted on the baggage slide 149 rather than the door. The same arrangement can be used with any of the roors which open about hinges along their bottom edge.

Figures 28—30 illustrate a container 60*d* having the same door construction as the container 60*c* illustrated in Figures 21—24. The door 68*c* is mounted by means of a double hinge assembly 140*a* which includes the hinges 141*a*, 142*a* and the joining plate 143*a* but omits the cam bracket 144. In place of this, the container at the centre of the hinge assembly 140*a* has a reinforcing boss 155 which supports a stud 156. Pivotally mounted on the stud 156 is a rocker cam 157. To permit use of the boss 155, a portion of the hinge 142*a* and of the hinge joining plate 143*a* is cut away.

The rocker cam 157 is triangular in shape with its base inverted and closely adjacent the bottom of the hinge 141*a*. It pivots about a point near its top whereby pivotal shifting of its depending apex will cause one of its corners to engage and push against the hinge 141*a*.

As the container 60*d* is moved in the direction of the arrow (Figures 28 and 29), a raised trigger 133 engages the bottom of the

rocker cam 157, pivoting it to cause one corner to lift the door 68*c* to unlatch it. This arrangement has the advantage of applying the full opening force to the door itself thus forcing it to unlatch rather than applying some of the lifting force to the container. This is significant in situations in which the door is jammed or partially jammed by heavy luggage pressed against it. It will be seen that the arrangement permits the wheels 150 which hold the container on the conveyor to pass beneath the boss 155 and between the rocker cam 157 and the recessed front face of the container.

It will be recognized that this mechanism is bidirectional. The rocker cam will function effectively to open the door 68*c* whether the container is moved to the right or to the left.

It will be recognized that the tray constructions illustrated in Figures 15—24 and Figures 28—30, while shown and described as providing a door at one end only of the tray, permit the tray to be designed with identical door arrangements at both ends of the tray to satisfy the requirements of installations needing such. Another advantage of the construction shown in these figures is the fact that the tray is capable of operation with the same door opening and closing devices irrespective of the direction of approach to the door opening devices. The door closing device 151 (Figure 15) can be adapted to bi-directional operation simply by making it with two oppositely directed sloping door engaging cams thus forming an isosceles triangle.

## The Discharge Station

To cause the container to discharge its contents at either the sorting and dispensing station or the baggage claim area, the container is inclined at an angle to the horizontal at those points of discharge with the door positioned at the downward end of the container. Specifically, as seen in Figures 4 and 6, a container 60 which has arrived at a discharge station such as the baggage claim area 46 has been inclined due to the inclination of a discharge conveyor 131, the latter being accomplished by conventional means such as tilted rollers. Alternatively, the discharge conveyor can be a portion of a truncated cone. A baggage slide or apron 149 is positioned adjacent the end of the container to be opened to receive the baggage discharge from the container 60, the apron preferably being inclined at the same angle as the container. The container is guided along the inclined conveyor by rollers 150. Thus, the container will readily deliver baggage by gravity when either the solenoid 96 or the trigger 133 acts.

Door closing means are provided to close the door of the container after it has discharged its contents at such a discharge station. The door closer forces the door into the latch position. There are a number of ways of accomplishing this. With respect to the embodiment utilizing the door 68 or 68*c* hinged to the floor, a bar 151 (Figure 15) can be attached to the conveyor downstream from the discharge area, the bar being shaped to provide an inclined ramp to gradually force the door of the tray to close. Although the door shown in Figure 15 is hinged to the tray floor, the bar 151 will work as well on doors hinged to the tray side wall. In the case of the embodiment utilizing a door hinged at the side wall, the closing mechanism can be a plate 153 (Figure 12) attached at the downstream side of the discharge station and positioned to gradually cam the door 68*a* closed.

A variety of discharge stations can be designed for the system and can be positioned anywhere which is convenient for the intended function. Figure 4 depicts an illustrative baggage claim area wherein two baggage call units or receptors 48 are positioned so as to be utilized simultaneously. That is a baggage claimant inserts his baggage claim check or an equivalent code-bearing element containing the identification of his baggage (such as his baggage ticket number) into the receptor or reader 48. The check is read automatically, thereby generating a coded signal which is transmitted to the computer. The container having the baggage is located by the computer and directed to the claim area 46 where the container door is opened automatically to discharge the baggage. Meanwhile, another baggage claimant may have inserted his claim check in the reader, causing other containers to be in the process of moving to the claim area 46. Since the owners are there waiting for their baggage, there is a substantially reduced risk of theft. Further, without the proper identifying claim check, the invention will not bring any baggage to the baggage claim area. Thus, the baggage is never there unless a claimant having the baggage's identification has demanded it. To further increase the use of that one discharge station, a second baggage call unit 48 is positioned at the other side of the apron 149, thus allowing a large number of persons to make their claims and await the arrival of the baggage.

It is desirable to spread the discharge of the baggage across the width of the claim area. In the case of the triggers 133 illustrated in Figures 19 and 20, this is accomplished by actuating the triggers one by one progressively across the length of the apron 149. When the last one has been actuated, the sequence returns to the initial end of the apron and is repeated. In the case of the containers which are equipped to be released

by a mechanism at the back of the container such as is illustrated in Figures 7 and 12, an indexing mechanism 200 (Figure 25) is provided. The mechanism includes a chain 201 on which the solenoid 96 is mounted, the chain 201 being held within a track 202 (Figure 6). The chain 201 is mounted on sprockets 203 and is driven by a sprocket 204 driven by reversible motor 205. The motor is controlled by a switching mechanism 206 which in turn is actuated by limit switches 207 and 208, the limit switches being spaced apart at the limits of travel of the solenoid 96. These limits are generally determined by the width of the apron 149. A stop 209 is mounted on the chain 201 and moves from one limit switch to the other, thereby causing the solenoid 96 to reciprocate back and forth across the width of the apron 149.

The mechanism can be designed to move the solenoid 96 continuously or step-by-step. Other mechanisms for effecting spaced discharge of the baggage may be utilized instead of these described.

Figure 2 illustrates another embodiment for the discharge station, which embodiment can also serve as a loading station at the check-in area 20 with a slight modification as hereinafter described. In both cases a code unit 300 is positioned at the station. Also in both cases, the station comprises a cabinet 301 designed to accommodate a single container 302 which container differs from the earlier containers described by lacking a door 68. A portion of the conveyor (not shown) passes through the inside of the cabinet carrying the containers therewith, the inside of the cabinet carrying the containers therewith, the cabinet having a retractable door covering the opening through which the bag is either placed or withdrawn in either loading or unloading, respectively, the container. If the station illustrated in Figure 2 functions as a discharge station, an actuator element similar to solenoid 96 is attached to the cabinet. When the arrival of the desired container is sensed, the actuator opens the retractable door and the baggage is withdrawn by the owner. Means can be included to temporarily halt the conveyor for a prescribed period of time upon the opening of the retractable door, and an alarm can be utilized to sound when that time is drawing to a close so that the system will automatically continue the movement of the conveyor and yet not injure the person attempting a withdrawal of baggage. It is also possible to cause the automatic ejection of the bags from the container while the door is open. On the other hand, if the station illustrated in Figure 2 is functioning as a loading or check-in station, the door includes means for holding it permanently open so that baggage can easily be loaded as an empty container moves into position.

When the station illustrated in Figure 2 is utilized as a check-in station, the code unit 300 has means to record the necessary information to direct the baggage to the proper flight. In the more sophisticated forms of this invention, it may also receive information concerning the specific identity of the baggage. When this same station is used as a baggage claim station the code unit is a reader which transmits to the computer the identity of the individual baggage.

Figure 3 illustrates still another embodiment of the discharge station, the station there illustrated being the sorting and dispensing station 30 for loading the plane. This station has an elongated slide or apron upon which the baggage is discharge from the containers. This apron is divided by partitions 342 in a plurality of individual bins 340 arranged side-by-side, the number being determined by the volume of baggage to be handled by the particular facility. At this station, the incoming baggage checked by departing passengers is discharged into the bins from which it is loaded on carts or other suitable vehicles and taken to the appropriate flight. How this arrangement functions within the concept of this system will be explained subsequently.

## Control of the System

It will be readily apparent that in the more complex and sophisticated form of this invention, it will be necessary to utilize a mechanism to keep track of the contents and the location of each filled container and to compare that with the information carried by the coded signal generated by the baggage call units 48. This can be accomplished in a number of ways, the one illustrated herein utilizing a computer having conventional information storage banks and conventional means for comparing information conveyed thereto in a coded signal with the information stored in the banks.

The computer may comprise a single computer 352 which receives all the data directly or a master computer 354 which receives data from a satellite computer 352 (Figure 14).

The location and identity of the individual containers may be handled in several ways. One way is to assign an identification to each individual container and to feed this information into the computer. Thereafter, the computer at all times maintains an accurate memory of the location of each individual container throughout the entire system.

Another arrangement is to supply the same information to the computer and also equip the conveyor system with readers 360 at various points along the conveyor (Figure

1). In this case, each container is equipped with an identification plate 361 (Figure 5) on which is impressed a code corresponding to that already supplied to the computer. This code is read each time it passes a reader and this information then updates the computer's information concerning the location of the particular container.

The information on the plate 361 can be coded in any suitable manner such as magnetically or by an optical pattern as by use of different colours. The readers 360 will be of a type capable of reading the type of coding utilized.

When the readers 360 are used, one is provided at each diversion point. The diversion points include, for example, all the switching locations such, for example, as switching area 42 (Figure 1). When a container is shuttled into the storage area 28 and onto one of the storage conveyors 32, repeated sensing is not needed inasmuch as each time a container is withdrawn from the storage conveyors 32, the containers which are on the input side of that withdrawal are indexed down through the storage area, one at a time, and the indexing is conventionally registered in the computer simultaneously to indicate that the container has been moved up accordingly. When a coded signal is sent to the computer by means of a baggage call unit 48, that signal is compared with the information stored in the banks and the particular location of the container having the identical information is found from the information storage banks. If the container is then in storage, means are actuated to push the container out of the storage area 28 onto the through conveyor 29. When the container is sensed as having arrived at the appropriate bin in either the sorting and dispensing station 30 or the baggage claim area 46, of which there may be several, the computer recognizes via the adjacent sensors 360 that the contents have been called for at that particular discharge station and activates the proper trigger to discharge the contents of the container at that particular station or bin. When the baggage is so discharged, the computer memory of the identification of the baggage is erased by conventional means. For example, this could be accomplished when new baggage is installed in that particular container, the computer erasing the identification formerly given to that container number.

In a more sophisticated form of this invention, a baggage check having several parts is created. This check 400 illustrated in Figure 26 consists of a visual portion 401 which may be used to manually trace the bag should it for some reason become lost or the claimant lose the claim portion of the check. This check is given a specific identification code either before or at the time of check in. This code is impressed upon both of the coupons 402 and 403. The various portions of the claim check may be separated from each other along lines such as a perforation line 406. At check-in, the baggage is equapped with one of the checks 400 which is then divided with the visual portion 401 and the coupon 402 remaining with the bag and the visual portion 404 and the coupon 403 retained by the passenger or claimant. The flight number is then supplied to the computer through the code unit in the same manner as has been previously described.

When the baggage is received at the airport where it is to be reclaimed, the operator loads the bag on one of the containers, removes the coupon 402 and drops it into a reader. The reader transmits the coded identification of the bag to the computer which stores this information until the baggage is called for by the passenger. The passenger claims his baggage by inserting the coupon 403 in the reader 48 at the claim station. The signal generated by the reader instructs the computer to forward the container having his baggage and to cause it to be discharged at that particular claim station.

The information can be coded on the coupons in any suitable manner such as magnetically or, for example, by a particular hole pattern punched through the coupons. It will be recognized that additional coupons may be incorporated into the claim check to travel with the baggage to effect partial or total automation of the in-transit transfer of the baggage from one airline to another.

To effect this a baggage check 400$a$ having visual portions 401 and 404 and coupons 402 and 403 is provided (Figure 27). This check in addition has one or more intransit coupons 405 which remain with the baggage. If more than one inter-line transfer is required, additional coupons may be provided with the transfer information arranged coupon by coupon in the order in which the transfers are to be effected.

While it is unlikely that any airport will for some time be equipped with inter-line baggage transfer conveyors, the use of an in-transit coupon has significant advantages. The operator loading baggage from a plane on the conveyor does not have to determine whether the baggage is destined for another flight or for claim at this airport. He merely uses the first remaining coupon. If this is an inter-line or in-transit coupon, it will automatically route the baggage to a station specifically assigned to baggage to be transferred to other lines. Thus, the system will automatically distingush between in-transit and terminating baggage.

Since many of the smaller airports will not be equipped with the baggage claiming equipment required by this system, the visual por-

tion may be used by the passenger to identify and claim his baggage. This arrangement when used in a fully equipped airport eliminates the possibility of improper encoding of the baggage claim system by the operator receiving the baggage from the plane and placing it in the containers.

Whether or not the baggage identification system shown in Figure 27 is utilized, it will be necessary to transfer the baggage checked by a passenger from the containers to the flight which is to transport it. This transfer is effected at the station illustrated in Figure 3. In any airport having sufficient baggage handling volume to warrant the use of the type of system contemplated by this invention, the handling of the baggage will be under the control of a baggage master. When flight time approaches, he will designate one of the bins 340 as the bin to receive all baggage for that particular departing flight. This information will be supplied to a control member which may be a computer and to the operator responsible for doing the actual work. The control member or computer will then direct all containers which have been identified as containing baggage for that particular flight to the particular bin 340 selected for that flight. The control member or computer will cause the containers to discharge all baggage destined for that flight into that bin. This eliminates operator error since the operator is not concerned with identification of the baggage. By the simple fact that it is discharged into the particular bin, he knows which flight is to receive it.

## Simplified System

Figure 31 illustrates a much simplified baggage handling system in which the necessity of a computer is eliminated. In this arrangement, the baggage is checked in at a baggage check station 500. At this station, it is placed in one or more containers and a code is imposed upon the container in any suitable manner such as magnetically. For this purpose, a code carrying plate 361 may be mounted at any suitable point on the container (Figure 21). This code identifies the flight which is to receive the baggage.

The loaded container is then transported to the out-bound baggage storage area 502. As the container enters this area, its code is read by a reader 503. The reader passes its information to a selector 504 (Figure 14A) which may be mechanical or electronic. Based on information which has previously been supplied to the selector by the baggage master, the selector either permits the container to pass through the storage area or directs it to be placed in one of storage cells 505 arranged along the conveyor in the storage area 502. If the baggage is identified as destined for a flight which is then ready to load, the container passes through the storage area directly to the flight loading discharge area 506. However, if no bin 340 has as yet been designated to receive the baggage, the container will be shunted into one of the storage cells or receiving elements 505.

In a preferred arrangement, the first containers arriving at the storage area 502 which are to be held in storage are shunted into the cell or receiving element nearest the out-bound flight loading area 506. As subsequent containers arrive, they will be moved to occupy the next adjacent cells in progression away from the flight loading area in the order in which they arrive at the storage area. As they enter the storage area, the reader will identify and with this information the selector will store the information concerning the cell to which they have been shunted. Later, when the flight for which they are identified is called for, the selector will be activated and starting with the container nearest the flight loading station 506, will withdraw them one by one from their storage cells and return them to the conveyor. As each container is removed, all the remaining containers further from the flight loading station will be moved one storage cell toward the flight loading station and the selector will log this fact. This will continue until all containers having baggage destined for the particular flight have been removed from storage.

At the entrance to the flight loading station, a reader 503 is provided which reads the coded information on the container and passes this information to a control member. When the container reaches the bin 340 to which the baggage is assigned, the control member will cause the container to discharge. This can be done by conventional mechanical or electronic means, the containers as they pass the bins being kept track of in a step-by-step fashion. Once again, the operator removing the baggage from the individual bins and loading it on the carts 36 does not have to identify its destination since the system will deliver to him only baggage destined for one particular flight. This system is schematically illustrated in Figure 14A.

As the empty containers leave the flight loading station 506, the coded information on the code plate 361 can be wiped by suitable means such as the wiper unit 508. This function, of course, can be combined with that of the next encoding.

The empty containers then proceed to the inbound baggage receiving station 509 where they are once again loaded and, if necessary, recorded by the encoder 510. The information is supplied to the encoder by an operator through the information he puts into dispatching unit 22. Some type of conventional container accumulation area may be provided between the flight loading station 506 and the inbound baggage receiving station 509 to

provide a temporary empty container holding area when there is a significance disparity between the number of containers being unloaded at station 506, and the number of containers needed at station 509 and the container supply for station 500 is adequate. Such an accumulation area may be provided elsewhere along the system.

Along the conveyor line 511 connecting the inbound baggage loading station 509 and the passenger baggage claim area 512 another storage area 513 may be provided to hold baggage which has been received but should not yet be delivered to the baggage claim station. If the system does not incorporate means whereby the baggage is to be brought to the claim station only upon demand of the passenger, the storage facility 513 is not normally necessary. However, if it does have the passenger demand feature, this storage area 513 is necessary to accumulate and hold the loaded containers until they are demanded. When such a system is used, the operator at the inbound station 509 will encode each container with the specific identification of the container's contents and this will be transmitted to a memory element and also read by the reader 514 as the container enters the storage area 513. Thereafter, the container will be shunted to a specific storage cell or receiving element with the information as to the container's location and contents identity being retained by a selector 515. When the passenger inserts the identification code in the reader 48 at the claim station, the selector upon signal from the memory element will cause the proper container to be withdrawn from storage and sent to the claim station. It will also, if required, prepare the claim station to discharge the baggage on the proper location adjacent to claimant. This arrangement is schematically illustrated in Figure 14B.

It will be recognized that the principles of this invention can be practised in a system which is designed only to handle baggage from the check-in station to the outbound flight loading station with an entirely different system being employed for inbound flight baggage. By the same token, such a system can be limited to movement of inbound baggage from the inbound loading station to the claim station with an entirely different system being employed for outbound baggage.

It will also be recognized that many types of conveyors and conveyor components may be used to execute the principles of this invention. There are various control systems which may be used varying widely both in type and degree of sophistication.

Other modifications will be apparent to one skilled in the art, such as the use of additional storage areas to receive the load on storage area 28 in the event it is desired to confine storage area 28 to accommodate essentially only the total number of flights capable of departing or arriving at the airport at any one time.

WHAT WE CLAIM IS:—

1. A baggage conveyor system comprising: a plurality of baggage carriers; conveying means arranged to transport the carriers; a discharge station; means at the discharge station for receiving a coded signal and supplying it to comparing means; means arranged to supply to the comparing means signals denoting the baggage carried by at least one of the carriers; and at least one actuator element which is arranged to cause a carrier to discharge its load at the discharge station in response to a finding by the comparing means of compatibility between the signals denoting the baggage carried by that carrier and the signals received by the receiving means.

2. A baggage conveyor system as claimed in Claim 1 in which the means arranged to supply signals denoting the baggage carried by a carrier includes a computer-like storage bank.

3. A baggage conveyor system as claimed in Claim 1 which includes means arranged to code the carrier as containing new contents, the coding means being operatively associated with a loading station where carriers are loaded with baggage, and in which the conveying means is arranged to transport the carriers from the discharge station to the loading station.

4. A baggage conveyor system as claimed in Claim 3 in which the coding means includes a computer-like storage bank.

5. A baggage conveyor system as claimed in Claim 3 or Claim 4 in which the discharge station and the loading station each comprises a cabinet designed to accommodate a single carrier at a time, a portion of a conveyor means passing through the inside of the cabinet, the cabinet having a retractable door thereon, and the actuator element being operatively connected to the door to open the door upon the said finding of compatibility.

6. A baggage conveyor system as claimed in Claim 5 in which the actuator element is attached to the cabinet, and the door includes means arranged to hold it open in the event that the cabinet is functioning as a loading station.

7. A baggage conveyor system as claimed in any of the preceding claims which includes means arranged to locate the carrier bearing the baggage denoted by a coded signal received by the receiving means.

8. A baggage conveyor system as claimed in Claim 7 in which the locating means includes a computer-like information storage bank.

9. A baggage conveyor system as claimed in Claim 7 or Claim 8 which includes means arranged to store the carriers with their loads, the locating means being arranged to search at least the storing means in order to locate the carrier.

10. A baggage conveyor system as claimed in Claim 9 which includes means arranged to retrieve the carrier from the storing means upon the finding by the comparing means of said compatibility.

11. A baggage conveyor system as claimed in Claim 10 which includes means arranged to index the remaining carriers through the storing means as a carrier is retrieved.

12. A baggage conveyor system as claimed in any of the preceding claims in which the comparing means is a computer.

13. A baggage conveyor system as claimed in any of the preceding claims in which each of the carriers in an open-topped tray having a door in its side walls.

14. A baggage conveyor system as claimed in Claim 13 in which the tray includes two generally vertical sides, a floor and the door, the latter being hinged to one of the said two sides.

15. A baggage conveyor system as claimed in Claim 13 in which the tray includes two generally vertical sides, a floor and the door, the door being hinged to the floor in a manner permitting vertical reciprocation of the door with respect to the floor, and also includes means arranged to maintain the door in a closed position unless the door is raised vertically with respect to the floor.

16. A baggage conveyor system as claimed in Claim 15 in which the door is hinged to the floor by two spaced hinges one secured to the floor and the other to the door, and which includes a lever element pivotally mounted to the said one hinge and extending beneath the said other hinge, and means arranged to open the door, comprising the actuator element in the form of an actuator cam arranged to engage and lift the lever element, the lever element when raised lifting the door to such a position that it is no longer maintained in a closed position.

17. A baggage conveyor system as claimed in Claim 15 in which the door is hinged to the floor by two spaced hinges and which includes a downwardly projecting wedge member connected to and between the hinges, and means arranged to open the door comprising the actuator element in the form of an actuator cam arranged to engage and lift the wedge member, the wedge member when raised lifting the door to such a position that it is no longer maintained in a closed position.

18. A baggage conveyor system as claimed in Claim 15 in which the door is hinged to the floor by two spaced hinges one secured to the floor and the other to the door, and which includes a rocker cam having a pair of oppositely projecting wings and a depending finger, means mounting the rocker cam on the carrier for rotation about an axis near the upper edge of the rocker cam and between its projecting wings, and means arranged to open the door, comprising the actuator element in the form of an actuator cam arranged to engage the finger and rotate the cam about its mounting means urging one of the wings to lift the door to such a position that it is no longer maintained in the closed position.

19. A baggage conveyor system as claimed in any of Claims 13 to 18 which includes means arranged to cause the actuator element to open the door of each carrier at a location spaced from the locations at the discharge station at which the loads of other carriers are discharged.

20. A baggage conveyor system as claimed in Claim 19 in which the causing means includes means arranged to index the actuator element along the length of the discharge station.

21. A baggage conveyor system as claimed in any of Claims 13 to 20 which includes means arranged to close the door when the carrier leaves the discharge station.

22. A baggage conveyor system as claimed in any of Claims 1 to 18 which includes at least a second additional actuator element at the discharge station adjacent to the said actuator element, each of the actuator elements being positioned to discharge the load of any of the carriers into a different area of the station, and the receiving means including means arranged to assign the load of each container to only a specific one of the areas of the station, and which also includes control means associated with the means arranged to supply signals denoting the baggage carried by a carrier, the control means being arranged to activate only the one of the actuator elements which corresponds to the specific one of the areas to which the load of the carrier has been assigned.

23. A baggage conveyor system as claimed in Claim 20, in which the indexing means includes a chain on which the actuator element is mounted, a prime mover arranged to drive the chain and means associated therewith arranged to limit the movement of the actuator element.

24. A baggage conveyor system as claimed in Claim 23 in which the limiting means includes a stop mounted on the chain and two limit switches spaced apart at the limits of the desired movement of the actuator element.

25. A baggage conveyor system as claimed in any of the preceding claims in which the means arranged to supply signals denoting the baggage carried by a carrier comprises

memory means associated with the conveyor and arranged to receive and store signals identifying the contents of each carrier, and the receiving means at the discharge station comprises a reader.

26. A baggage conveyor system as claimed in any of Claims 1 to 24 in which the means arranged to supply signals denoting the baggage carried by a carrier comprises memory means associated with the conveyor and arranged to maintain as information the identity and location on the conveyor of each individual baggage container.

27. A baggage conveyor system as claimed in any of Claims 1 to 4 or Claims 7 to 18 in which that part of the conveyor passing through the discharge station is inclined, the discharge station is divided into a plurality of sections, each section having an actuator element which is associated with the conveyor and comprises a trigger element shiftable between retracted and actuated positions, the trigger element being arranged to engage a carrier when in its actuated position to cause it to discharge its load into the section associated with that trigger element, and the comparing means being connected to a control member having means for selecting trigger elements in response to the identity given each of the carriers.

28. A system as claimed in Claim 27 in which the selecting means of the control member has a discrimination unit for simultaneously activating the trigger elements of a plurality of sections in response to the identity given each individual one of a plurality of carriers.

29. A system as claimed in Claim 27 which has a check-in station; a carrier storage between the check-in and discharge stations; a selector at the carrier storage for determining whether the load of each carrier entering the carrier storage is then receivable by one of the sections of the discharge station; a plurality of carrier receiving elements in the carrier storage and shunt means for transferring invidual carriers to and from the receiving elements, the shunt means being arranged to be responsive to said selector to shunt any carrier into the receiving elements which is not currently receivable at the discharge station and to return it to the conveyor upon the selector receiving a signal that the carrier is receivable at the discharge station.

30. A system as claimed in Claim 29 in which the selector has means for discriminating between carriers based upon the signals denoting the baggage carried thereby.

31. A system as claimed in Claim 29 in which the receiving elements are arranged in a side-by-side pattern and which includes transfer means arranged to shift all of the carriers in the receiving elements towards one end of the carrier storage in response to the withdrawal of a carrier from a receiving element among a group of carrier occupied receiving elements; the selector having a memory element for recording the position of each of the carriers in the receiving elements as they progress from one receiving element to an adjacent one.

32. A system as claimed in Claim 27 which includes a computer-like member and in which both the control member and the means arranged to supply signals denoting the baggage carried by a carrier are connected thereto and controlled thereby.

33. A system as claimed in Claim 27 in which the means arranged to supply signals denoting the baggage carried by a carrier comprises a code carrying member mounted on each individual carrier, and a reader at the discharge station for reading the code carrying member, the reader being connected to the control member and the control member being responsive thereto.

34. A system as claimed in Claim 29 in which the means arranged to supply signals denoting the baggage carried by a carrier comprises a code carrying member mounted on each individual carrier and readers at the carrier storage and the discharge station for reading the code carrying member, the reader at the carrier storage being connected to the selector and the selector being responsive thereto and the reader at the discharge station being connected to the control member and the control member being responsive thereto.

35. A baggage conveyor system substantially as described herein with reference to the accompanying drawings.

KILBURN & STRODE,
Chartered Patent Agents,
Agents for the Applicants.

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Published by The Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.

1384593 COMPLETE SPECIFICATION
11 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 1

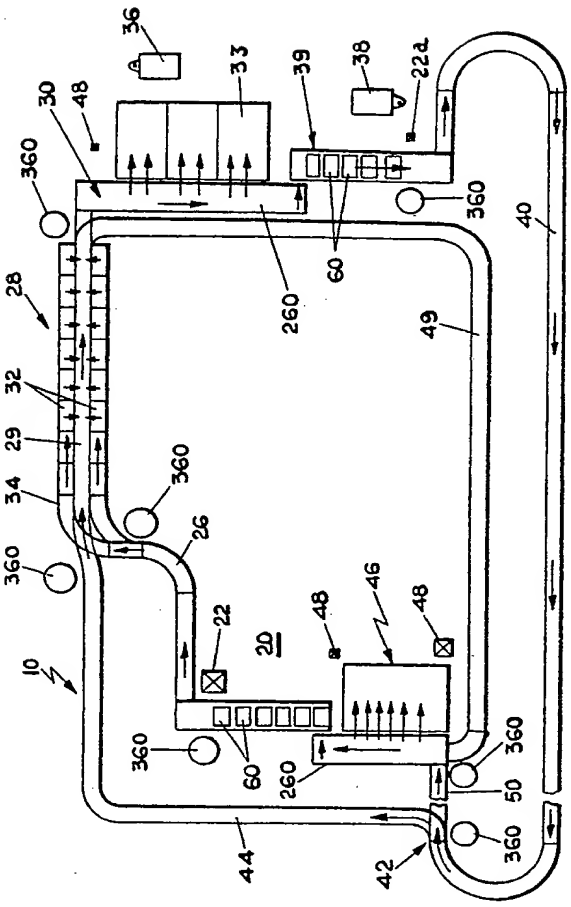



FIG. 1

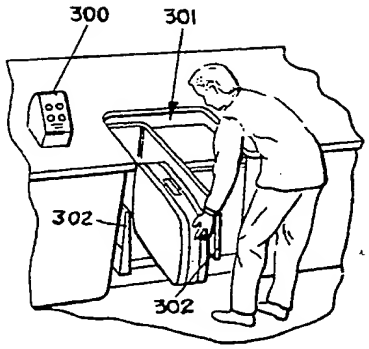



FIG. 2

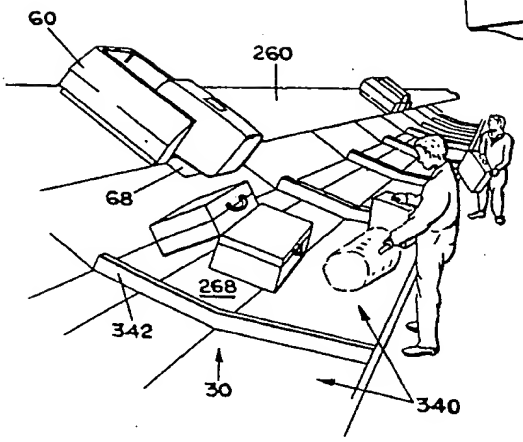



FIG. 3

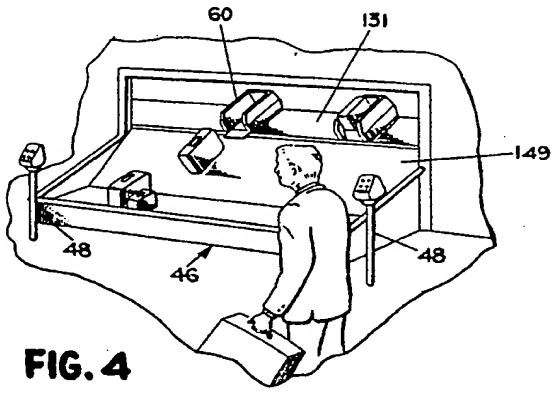



FIG. 4

FIG.5

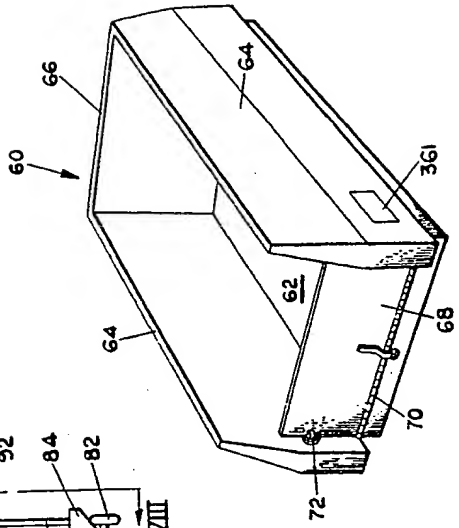



FIG.7

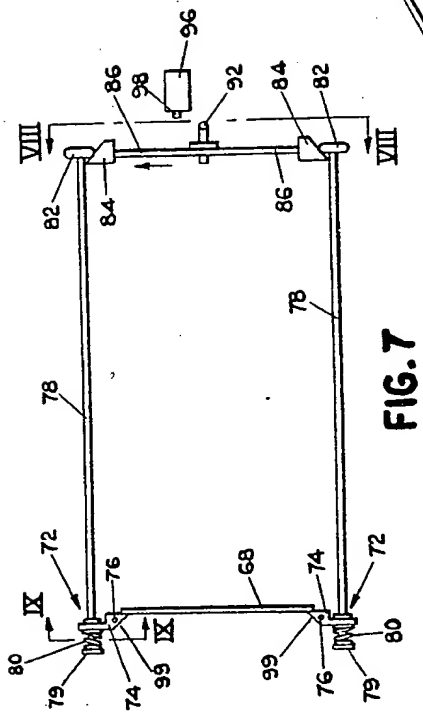
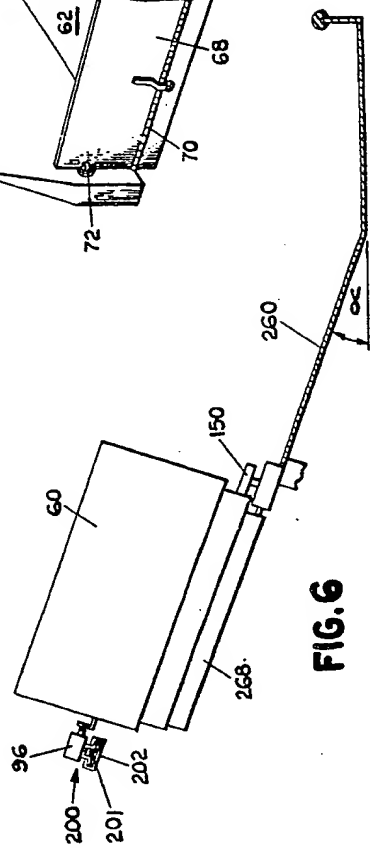



FIG.6



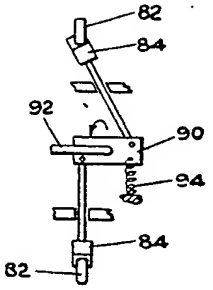



FIG.8

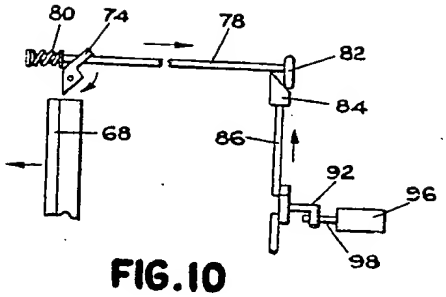



FIG.10

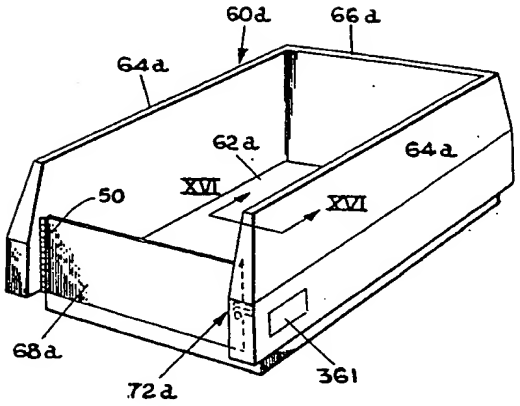



FIG.11

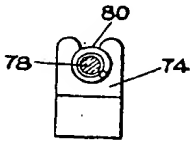



FIG.9

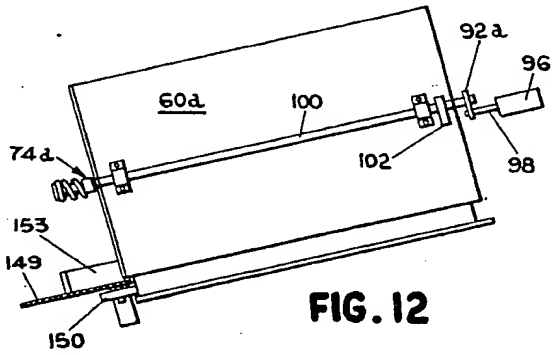



FIG.12

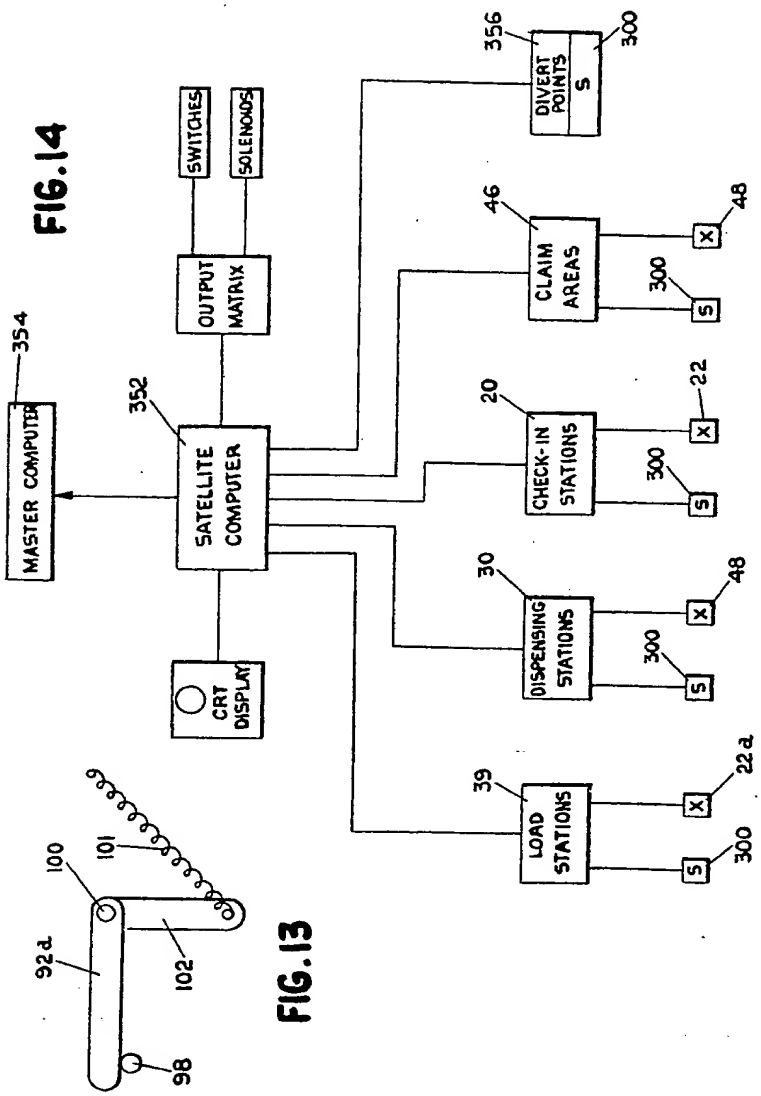

MASTER COMPUTER
354
SATELLITE COMPUTER
352
OUTPUT MATRIX
SWITCHES
SOLENOIDS
CRT DISPLAY
DIVERT POINTS
356
300
S
CLAIM AREAS
46
48
X
CHECK-IN STATIONS
20
22
DISPENSING STATIONS
30
LOAD STATIONS
39
22a

FIG.14


100
101
102
92a
98

FIG.13

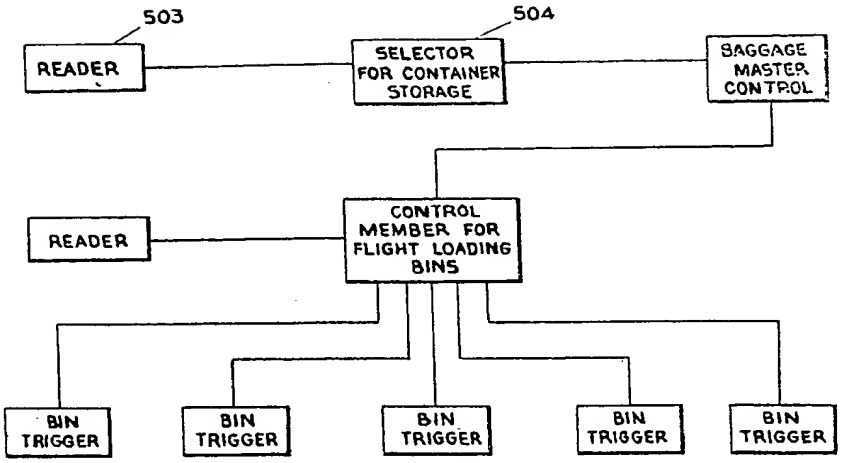



FIG. 14A

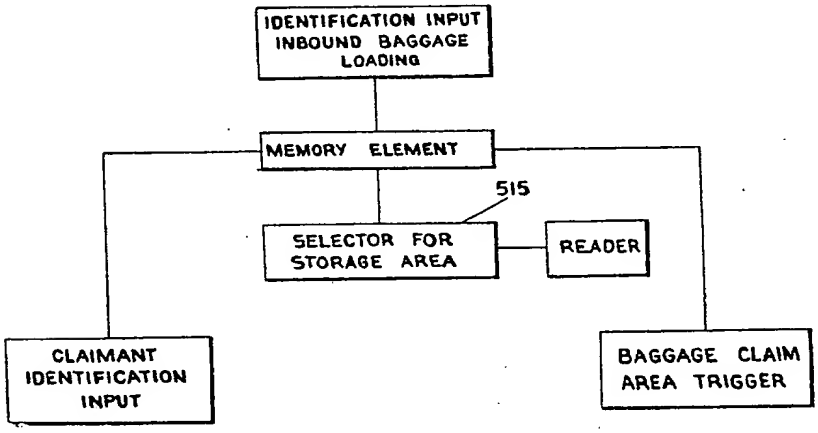



FIG. 14B

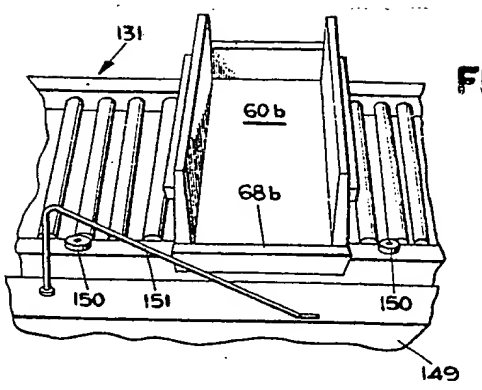



FIG. 15

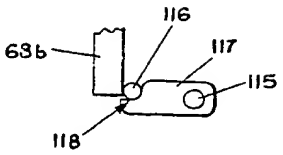



FIG. 17

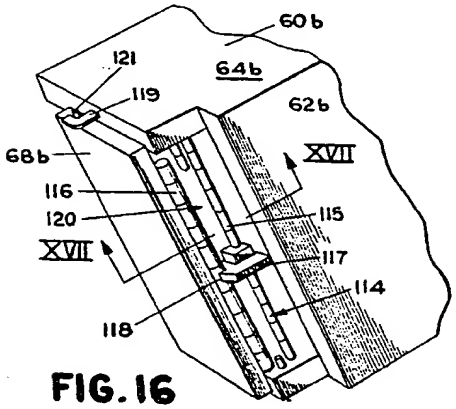



FIG. 16

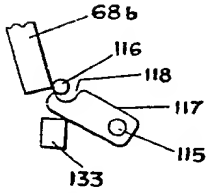



FIG. 18

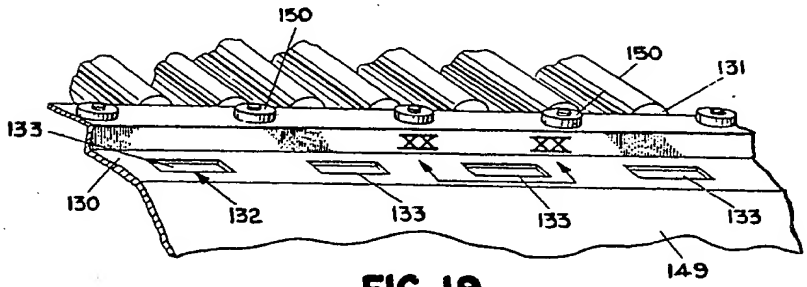



FIG. 19

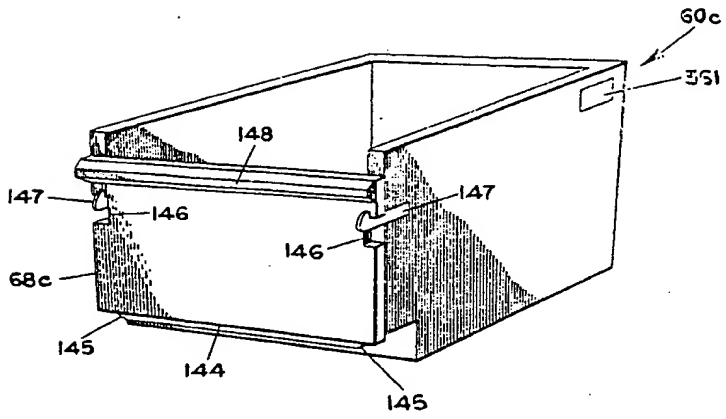



FIG. 21

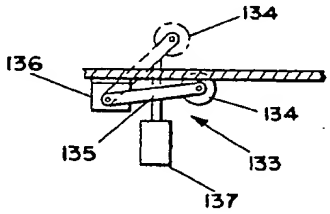



FIG. 20

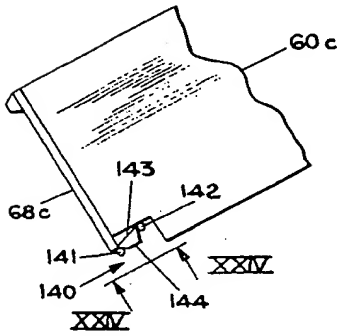



FIG. 22

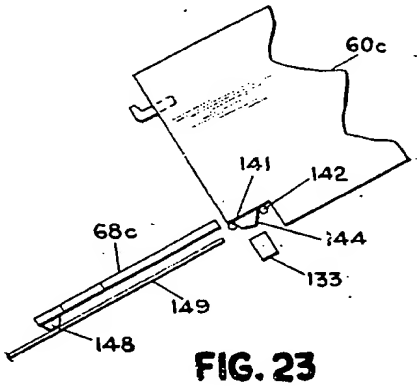



FIG. 23

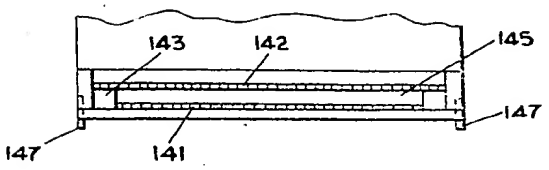



FIG. 24

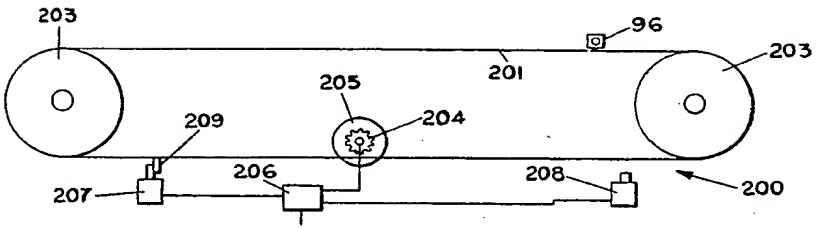



FIG. 25

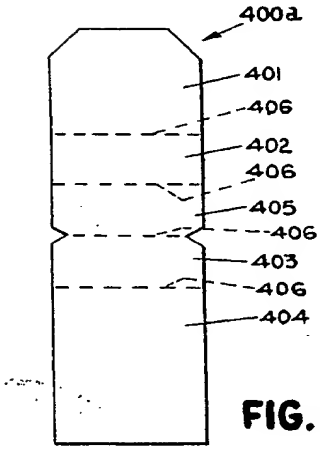



FIG. 27

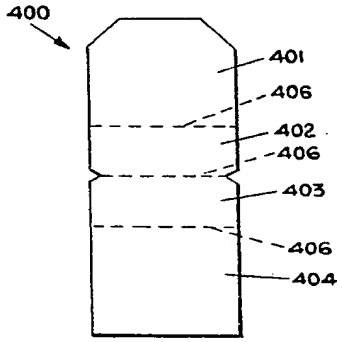
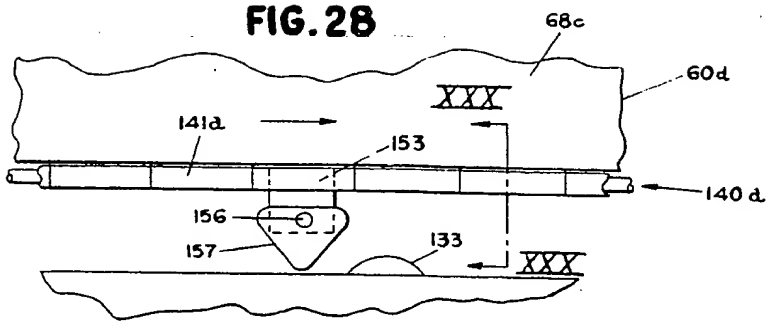



FIG. 26

FIG. 28



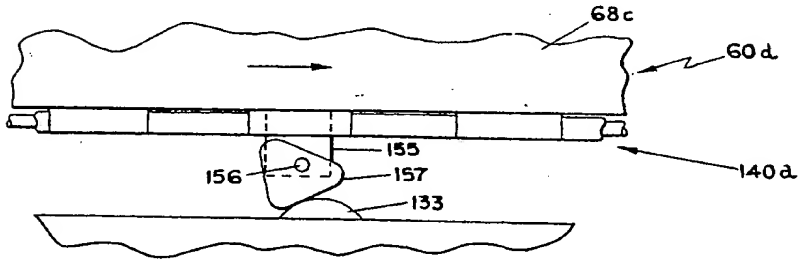
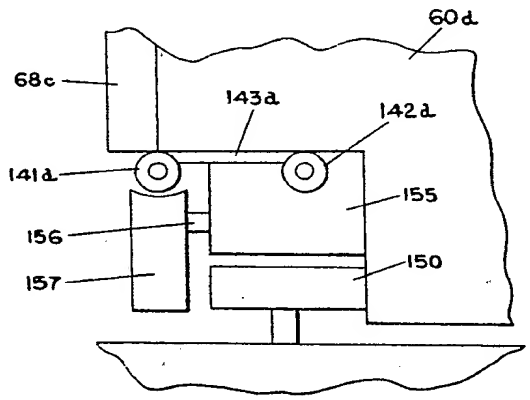




FIG. 29

FIG. 30



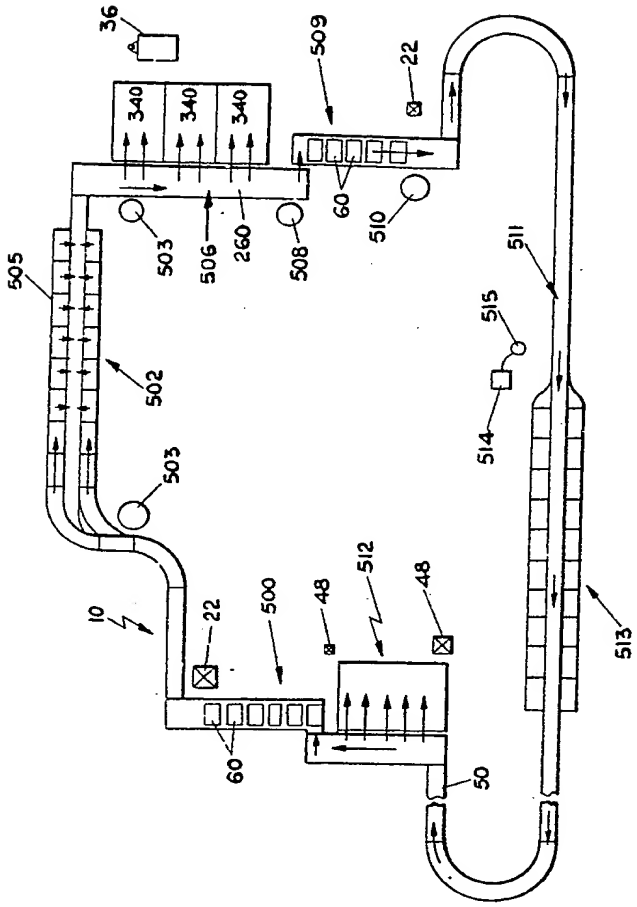



FIG. 31